

REMARKS/ARGUMENTS

Summary of the Office Action

Claims 1-87 have been canceled. Claims 89-94, 96-105, and 115 have been withdrawn. Claims 88, 116, and 118 have been amended. Claims 95, 106-114, 117, and 119-128 are also currently pending. No new matter has been added by any of the amendments to the claims.

The information disclosure statement filed on September 26, 2006 has been objected to for failing to comply with 37 C.F.R. §1.98(a)(2) in failing to include legible copies of each cited foreign patent document and non-patent literature publication.

The drawings have been objected to under 37 C.F.R. § 1.83(a) for allegedly failing to show every feature of the invention specified in the claims.

Claims 88, 95, 106-114, 116, 117, and 119-128 have been rejected under 35 U.S.C. § 112, first paragraph, for allegedly failing to comply with the written description requirement.

Claims 88, 95, and 116-119 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Hubner U.S. Patent No. 5,902,118 (hereinafter "Hubner").

Claims 106-108, 111-114, 120-122, and 125-128 have been rejected under 35 U.S.C. § 103(a) as being obvious over Hubner in view of Faris U.S. Patent No. 5,786,629 (hereinafter "Faris") and Sakui et al. U.S. Patent No. 5,615,163 (hereinafter "Sakui"). Claims 109 and 123 have been rejected under 35 U.S.C. § 103(a) as being obvious over Hubner in view of Faris and Sakui and Daberko U.S. Patent No. 5,787,445 (hereinafter "Daberko").

Claims 110 and 124 have been objected to for being dependent upon a rejected base claim, but have been said to be allowable if rewritten in independent form. Applicant notes with appreciation the indication of allowable subject matter in

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claims 110 and 124. Applicant reserves the right to re-write claims 110 and 124 in independent form.

The Examiner's objections and rejections are respectfully traversed.

The Objection to the Information Disclosure Statement

The Examiner objected to the Information Disclosure Statement filed September 26, 2006 for failing to comply with 37 C.F.R. §1.98(a)(2) by failing to include legible copies of each cited foreign patent document and non-patent literature publication.

Applicant is filing herewith an IDS re-citing and enclosing copies of the five (5) foreign patent documents and the eight (8) non-patent literature publications that were not initialed by the Examiner on the copy of the September 26, 2006 Form PTO/SB/08 returned with the last communication.

The Objection to the Drawings and Rejection Under 35 U.S.C. § 112

The drawings have been objected to under 37 C.F.R. § 1.83(a) for allegedly failing to show every feature of the invention specified in the claims. Claims 88, 95, 106-114, 116, 117, and 119-128 have been rejected under 35 U.S.C. § 112, first paragraph, for allegedly failing to comply with the written description requirement. Specifically, the Examiner has stated that the drawings and specification must show and disclose "a) a substrate comprising a first surface having interconnect contacts; b) a second substrate comprising a first surface having interconnect contacts; and c) conductive paths between the interconnect contacts," (see, e.g., Office Action, page 2, lines 14-17 and page 3, lines 7-9). Applicant respectfully submits that each of these features is described in the specification and/or shown in the drawings.

As shown in FIG. 1B and described on page 6, lines 1-17, for example, there is a first substrate or circuit layer 103a that has a top surface and a bottom surface, each surface having a bond and interconnect layer 105a. There is also a second substrate or circuit layer 103b that has a top surface and a bottom surface, each surface having a bond and interconnect layer 105b. Conductive paths exist between two adjacent interconnect contact layers 105a and 105b when those contact layers are bonded together, as described in applicant's specification (e.g., with respect to thermal diffusion metal bonding: see, e.g., page 12, lines 17-28).

Applicant respectfully requests, therefore, that the objection to the drawings under 37 C.F.R. § 1.83(a) and the rejection to claims 88, 95, 106-114, 116, 117, and 119 under 35 U.S.C. § 112 be withdrawn.

The Rejections Under 35 U.S.C. § 102

Claims 88, 95, and 116-119 have been rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Hubner.

Claims 88 and 95

Amended independent claim 88 is directed to an integrated circuit structure including a first substrate and a second substrate. The first and second substrates each include a first surface having interconnect contacts formed thereon, "the first surface of the second substrate being bonded by thermal diffusion to the first surface of the first substrate to form conductive paths between the interconnect contacts of the first surfaces of the first and second substrates." The second substrate is a thinned substrate having circuitry formed thereon.

Nowhere does Hubner show or suggest or make obvious an integrated circuit including a first substrate and a second substrate with "the first surface of the second substrate being bonded by thermal diffusion to the first surface of the first

substrate," as required by applicant's amended independent claim 88. Instead, Hubner describes a circuit arrangement in which multiple substrates are connected to one another via a polyimide adhesive layer or melted solder metal (see, e.g., Hubner, column 3, lines 16-26). A solder bond, such as that described by Hubner, is not a thermal diffusion bond.

Thermal diffusion bonding or thermal compression bonding produces a bond that has a substantially different structure than a solder bond. Soldering requires at least three metal layers including two adhesion surfaces and a solder metal layer. Soldering further requires melting of the solder metal. Soldering produces a bond that has a three-layered "sandwich" structure. A thermal diffusion bond or a thermal compression bond, on the other hand, requires only two layers of material (the two layers being bonded together), and does not require melting of any metal. Thermal diffusion bonding results in the bonding surfaces fusing together as atoms on each of the surfaces form atomic bonds with atoms on the opposing surface. The fusing of the bond surfaces produces a bond with a single-layer structure. The thermal diffusion bond may thereby produce a thinner and more flexible bond structure as no solder metal layer is required.

A notable property of thermal diffusion bonding is that thermal diffusion bonds are permanent and cannot readily be taken apart. In contrast, solder bonds are temporary and can be released by heating the solder metal. Therefore, soldering cannot be used to bond more than two substrates in a stack as the heating required to solder a third substrate to the stack will release the solder bonds in the stack and cause the stack to come apart. In order to form a stack of three or more substrates using solder bonds, Hubner uses a combination of solder bonds and adhesive polyimide layer bonds to obviate the need to heat substrates on which solder bonds have been formed (see, e.g., Hubner, column 6, lines 20-22 and 60-63).

However, thermal diffusion bonding or thermal compression bonding can be applied repeatedly to a stack of integrated circuit substrates in order to bond additional substrates to the stack. Repeated application of thermal diffusion bonding or thermal compression bonding does not pose the risk of releasing previously formed bonds. Applicant's invention, by included substrates bonded by thermal diffusion, thus presents a notable improvement on Hubner's integrated circuit substrate stack.

For at least these reasons, applicant respectfully submits that independent claim 88 and any claims dependent therefrom, including claim 95, are patentable in view of Hubner. Applicant respectfully requests, therefore, that the rejection of claims 88 and 95 under 35 U.S.C. § 102(b) be withdrawn.

Claims 116, 117, and 119

Amended independent claim 116 is directed to an integrated circuit structure that includes a first substrate having a topside surface with interconnect contacts formed thereon and a second substrate having a bottomside surface, the bottomside surface of the second substrate having interconnect contacts formed thereon and "being bonded by thermal diffusion to the topside surface of the first substrate."

As discussed above in connection with claim 88, applicant submits that Hubner does not show or suggest or make obvious the bottomside surface of a second substrate having interconnect contacts formed thereon and "being bonded by thermal diffusion to the topside surface of the first substrate." Instead, Hubner describes a circuit arrangement in which multiple substrates are connected to one another via a polyimide adhesive layer or melted solder metal.

For at least these reasons, applicant respectfully submits that independent claim 116 and any claims dependent therefrom, including claims 117 and 119, are patentable in view of Hubner. Applicant respectfully requests, therefore, that the rejection of claims 116, 117, and 119 under 35 U.S.C. § 102(b) be withdrawn.

Claim 118

Amended independent claim 118 is directed to an integrated circuit structure that includes a first substrate and a second substrate, wherein "the first substrate has a first surface bonded by thermal compression to a first surface of the second substrate."

As discussed above in connection with claim 88, applicant submits that Hubner does not show or suggest or make obvious a first substrate that has "a first surface bonded by thermal compression to a first surface of the second substrate." Instead, Hubner describes a circuit arrangement in which multiple substrates are connected to one another via a polyimide adhesive layer or melted solder metal.

For at least these reasons, applicant respectfully submits that independent claim 118 and any claims dependent therefrom, are patentable in view of Hubner. Applicant respectfully requests, therefore, that the rejection of claim 118 under 35 U.S.C. § 102(b) be withdrawn.

The Rejections Under 35 U.S.C. § 103

Claims 106-108, 111-114, 120-122, and 125-128 have been rejected under 35 U.S.C. § 103(a) as being obvious over Hubner in view of Faris and Sakui. Claims 109 and 123 have been rejected under 35 U.S.C. § 103(a) as being obvious over Hubner in view of Faris and Sakui and Daberko.

Claims 106-108 and 111-114

As applicant has pointed out above, amended independent claim 88 is patentable over Hubner. For at least the foregoing reasons, claims 106-108 and 111-114, each of which depends from claim 88, is patentable over Hubner in view of Faris and Sakui. As such, applicant respectfully requests that the rejection under 35 U.S.C. § 103(a) of claims 106-108 and 111-114 be withdrawn.

Claims 120-122 and 125-128

As applicant has pointed out above, amended independent claim 116 is patentable over Hubner. For at least the foregoing reasons, claims 120-122 and 125-128, each of which depends from claim 116, is patentable over Hubner in view of Faris and Sakui. As such, applicant respectfully requests that the rejection under 35 U.S.C. § 103(a) of claims 120-122 and 125-128 be withdrawn.

Claim 109

As applicant has pointed out above, amended independent claim 88 is patentable over Hubner. For at least the foregoing reasons, claim 109, which depends from claim 88, is patentable over Hubner in view of Faris and Sakui and Daberkow. As such, applicant respectfully requests that the rejection under 35 U.S.C. § 103(a) of claim 109 be withdrawn.

Claim 123

As applicant has pointed out above, amended independent claim 116 is patentable over Hubner. For at least the foregoing reasons, claim 123, which depends from claim 116, is patentable over Hubner in view of Faris and Sakui and Daberkow. As such, applicant respectfully requests that the rejection under 35 U.S.C. § 103(a) of claim 123 be withdrawn.

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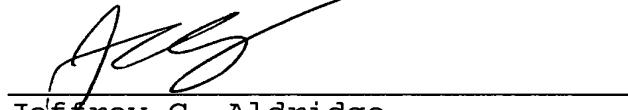
Withdrawn Claims

Applicant would like to point out that claims 89-94, 96-105, and 115, which depend from claim 88, are withdrawn. Once claim 88 is allowed, withdrawn dependent claims 89-94, 96-105, and 115 should be reinstated and allowed.

Conclusion

The foregoing demonstrates that claims 88, 95, 106-114, 116-128, and any claims dependent therefrom are allowable. This application is therefore in condition for allowance. Reconsideration and allowance are accordingly respectfully requested.

Respectfully submitted,



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The aforementioned references are listed on the  
accompanying Form PTO/SB/08 (submitted in duplicate). Pursuant to  
37 C.F.R. 1.98 (a) (2), copies of the aforementioned Foreign Patent  
Documents and Non-Patent Literature Documents are enclosed  
herewith.

Applicant reserves the right to establish the  
patentability of the claimed invention over any of the information  
provided herewith, and/or to prove that this information may not  
be prior art, and/or to prove that this information may not be  
enabling for the teachings purportedly offered.

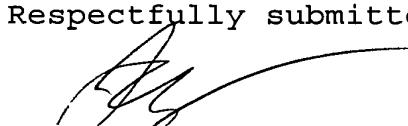
The above-identified documents were previously cited in an Information Disclosure Statement filed on September 26, 2006, and were not considered by the Examiner. These references are being re-submitted herewith for the Examiner's consideration.

It is respectfully requested that these references be: (1) fully considered by the Patent and Trademark Office during the examination of this application; and (2) printed on any patent which may issue on this application. Applicant requests that a copy of Form PTO-SB/08, as considered and initialed by the Examiner, be returned with the next communication.

This Statement is submitted with a Request for Continued Examination under 37 C.F.R. § 1.114. The Director is hereby authorized to charge \$180.00 in payment of the fee for submission of this Information Disclosure Statement pursuant to 37 C.F.R. §1.97(c)(2), payment of any additional fees required in connection with this Statement, or to credit any overpayment of the same, to Deposit Account No. 06-1075 (Order No.: 001202-0127). A duplicate copy of this Information Disclosure Statement is enclosed herewith.

An early and favorable action is respectfully requested.

Respectfully submitted,



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